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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

ECKERT II, GEORGE C

ART UNIT	PAPER NUMBER
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2815

DATE MAILED: 03/22/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/755,071

Applicant(s)

AHN ET AL.

Examiner

George C. Eckert II

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AW

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 10 December 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 19-28,30,31,33,34,37 and 39-42 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 19-28,30,31,33,34,37 and 39-42 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 1/15/04.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. Applicant's amendment dated December 10, 2003 in which claims 19, 31 and 40 have been amended, claim 42 added and claims 35 and 36 canceled has been entered of record.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 19, 21, 22, 24, 25, 28 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Anand in view of Min (both references of record). As made clear in the previous office action, Anand in view of Min teach the claimed structure and make obvious the instant claims.

Regarding the amended limitation of claim 19, Min teaches a process which achieves a Ti-Si-N layer with a step coverage of approximately 100% which is also the motivation for using the process. As such, the claims are again rejected as obvious over Anand in view of Min.

3. Claims 20, 23, 40, 41 and 42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Anand and Min et al. and further in view of Venkatraman et al. (of record). Anand and Min make obvious the structure of independent claim 19 as well as independent claims 40 and 42. Anand also teaches the use of an etch stop layer 24 or 26 used between insulation layers.

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However, they do not teach that the insulating layers may be formed of polyimide. Venkatraman et al teach that an insulating layer may be formed of silicon dioxide or polyimide (col. 4, lines 39-54). With regard to claim 40, Anand teaches that the integrated circuit which includes the dual damascene structure is formed as part of a ULSI circuit which is considered a processor. Anand also teaches that the integrated circuit having the damascene layers is formed on the same chip as the processor (see generally figures 21-24).

Anand, Min et al. and Venkatraman et al. are combinable because they are from the same field of endeavor. At the time of the invention it would have been obvious to a person of ordinary skill in the art to use polyimide as the insulator of Anand. The motivation for doing so is that such a material has a low dielectric constant such that parasitic capacitance between conductors is reduced. Therefore, it would have been obvious to combine Anand and Min et al. with Venkatraman et al. to obtain the device of claims 20, 23, 40, 41 and 42.

4. Claims 26 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Anand, Min et al and further in view of Reid et al. (of record). Anand and Min et al make obvious the device of claim 19. However, they did not teach that the Ti-Si-N liner layer is between 50-200 Å thick or specifically 100 Å thick. Reid et al teach, on page 229 in the right hand column, first full paragraph, that a layer of Ti-Si-N may be formed at a thickness of 10 nm (100Å).

Anand, Min et al. and Reid et al. are combinable because they are from the same field of endeavor. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to form the Ti-Si-N layer to a thickness of 100Å. The motivation for doing so, as is taught by Reid et al., is that such thickness is sufficient to prevent copper migration up to a

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temperature of 650° C. Therefore, it would have been obvious to combine Reid et al. with Anand and Min et al to obtain the invention of claims 26 and 27.

5. Claims 31, 33, 34, 37 and 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Anand in view of Venkatraman et al and Reid et al. As discussed in the above rejections, Anand teaches the structure of instant claim 31 but does not teach a polyimide insulator or a Ti-Si-N layer with a thickness of about 100 Å. Venkatraman makes obvious the use of polyimide and Reid makes obvious the thickness of 100 Å. As such, the instant claims are rejected there under.

Response to Arguments

6. Applicant's arguments filed December 10, 2003 have been fully considered but they are not persuasive. Applicant argues that Anand does not teach an organo-metallic-atomic deposited titanium-silicon-nitride layer as required by claim 19. While this is true, such limitation *is* taught by Min et al. and made obvious to include in the device of Anand as Min provides motivation for such process/product.

Applicant again argues that the limitation “organo-metallic-atomic deposited titanium-silicon-nitride layer” is not a product by process limitation but is rather a resulting structure. This argument simply won't stand. The limitation is a *product*, a titanium-silicon-nitride layer, resulting from the *process* of organo-metallic-atomic deposition. It is unclear how it can be anything *but* a product-by-process limitation. However, that argument aside, applicant has amended independent claim 19 to now require a “step coverage of about 100%” which, as argued

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by applicant, is the structural difference achieved when the organo-metallic-atomic deposition process is used. For support in tying the claimed process to a structural difference, applicant points to Min et al., which teaches that an organo-metallic-atomic deposited titanium-silicon-nitride layer has a step coverage of about 100%. The examiner concedes that Min et al. teach an organo-metallic-atomic deposited titanium-silicon-nitride layer. However, in addition to applicant's use of such teaching, the examiner further believes that Min et al. motivates its use in the device of Anand and thus makes obvious the instant claims.

Applicant disagrees and states that the instant invention would not be obvious over Anand and Min et al. Specifically, applicant argues that the instant rejection must fail because Anand fails to teach a dual damascene structure having the claimed elements and Min fails to remedy these shortcomings (remarks, p. 10). But this simply is not true. Anand does teach a dual damascene structure as clearly shown in the cited figures (e.g. fig. 19 shows a dual damascene structure on the right hand side of the figure) and as claimed by Anand (claim 1, col. 15, line 2). Anand also teaches a Ti-Si-N layer 20 lining the via of the dual damascene structure. The only thing Anand does not teach is the process by which the Ti-Si-N layer is deposited and thus, arguably, the step coverage as instantly claimed. However, Min et al. teach such a process and motivate its use. Even applicant seems to concede the motivation to use Min's process by pointing to its advantages in the instant remarks (page 9, 2nd full paragraph). As such, arguments that Anand and Min don't teach and/or don't motivate the instant combination are not persuasive.

Applicant further argues the combination of Anand and Min, stating that they are directed toward different inventions; Anand is concerned with bond pad formation while Min is directed

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toward a specific process of Ti-Si-N deposition. This argument is not persuasive. Anand does teach a bond pad formation. However, Anand also teaches the dual damascene structure as instantly claimed. Moreover, Anand teaches that the damascene structure is lined with a barrier metal 20 such as Ti-Si-N. Min teaches a method of depositing Ti-Si-N such that it has better step coverage. While Min may not be concerned with bond pad formation that certainly does not belie the fact that Min motivates its use with Anand insofar as deposition of the Ti-Si-N layer. Anand and Min have much more in common than merely being formed on similar substrates. Min teaches the instantly claimed step coverage and motivates its use in Anand. As such, the arguments to the contrary are not persuasive.

The remaining arguments are directed to the purported failure of either Venkatraman or Reid to teach an organo-metallic-atomic deposited titanium-silicon-nitride layer. However, such layer was taught by Min et al which reference also motivates its use. As such, the remaining arguments are not persuasive.

Conclusion

7. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37


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CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to George C. Eckert II whose telephone number is (571) 272-1728. The examiner can normally be reached on 8:00 - 5:30, alternate Fridays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on (571) 272-1664. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


GEORGE ECKERT
PRIMARY EXAMINER